UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
WASHINGTON, D. C.
H. H. BENNETT, CHIEF

ADVANCE REPORT

on the

SEDIMENTATION SURVEY OF LAKE HARRIS

TUSCALOOSA, ALABAMA

October 30 - November 6, 1935

by

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Division of Research

Sedimentation and Hydraulic Studies

SCS-SS-4
5-15-36

SEDIMENTATION IN LAKE HARRIS

TUSCALOOSA, ALABAMA.

GENERAL INFORMATION

Location: State: Alabama.

County: Tuscaloosa T. 20 S., R. 9W.

Direction and distance from nearest city: 8 miles, airline, northeast of Tuscaloosa, Alabama; 16-1/2 miles by road.

Drainage: Yellow Creek; there are no important tributary valleys in which water is impounded.

Ownership: City of Tuscaloosa, Alabama.

Purpose served: Municipal water supply.

Description of dams: The main dam is an arch type, concrete structure, 65 feet high, having an arc length of 306 feet, and chord length of 270 feet. Its top thickness is 5 feet, and bottom thickness 20 feet. At its base there is a 30 inch valve, which is occasionally opened with consequent removal of a negligible amount of sediment.

The spillway dam, in the saddle of a ridge 1600 feet southeast of the main dam, is an arch type, concrete structure between two circular tower abutments 117 feet apart. Between the north abutment and bank is a straight dam segment 41 feet long; and between the south abutment and bank is a similar segment 65 feet long. The main semi-circular dam section is 4-1/2 feet thick at the top and 5-1/2 feet at the base. The crest elevation, including 12-inch flashboards, is 202 feet above mean sea level.

Date of completion: February 1929. This survey was made in November, 1935, at which time the lake was 6.75 years old.

Length of lake, original and present (scaled from base map): 3.5 miles

Area of lake at crest level, original and present (determined by this survey): 149.05 acres.

Capacity of lake at crest level (determined by this survey):

Original	2,421 acre feet
Present	2,373 acre feet
Loss due to silting	48 acre feet

Area of watershed: 30 square miles by planimeter measurement of drainage area as shown on the Searles and Samantha Quadranges of the U.S. Geological Survey. 1/

1/ U. S. Geol. Survey Topographic sheets, Searles and Samantha Quadrangles, Ala. scale $\frac{1}{62500}$, contour interval 20 feet.

General character of watershed:

Geology: The watershed of Yellow Creek above Harris Lake is underlain in about two-thirds of its area by Coal Measures, sandstone and shale of Pennsylvanian age, and in the remaining one-third by Coastal Plain sediments, chiefly gravels, sands, and sandy clays of Cretaceous age and younger. The Coastal Plain deposits rest unconformably on the older rocks and occupy all higher divides and upland interstream areas. In addition a veneer of materials derived from these sediments has spread by soil creep and sheet erosion down the slopes over nine-tenths of the whole area.

The Coal Measures are of Pottsville (lower Pennsylvanian) age and consist of practically flatlying strata with a slight regional dip to the south. The principal rock types are shales and sandy shales capped by a thick layer of sandstone. A few miles south of the watershed of Harris Lake these rocks dip under the Coastal Plain sediments and do not reappear at the surface farther to the south.

The watershed is in the center of the curve where the inner margin of the Coastal Plain bends sharply northward into the Mississippi embayment of Mesozoic time. The gravels, sands, and sandy red clays of the Coastal Plain in this region occur as beds of loose, unconsolidated material. They were originally laid down in upper Cretaceous (Tuscaloosa) time, but a great portion of them have been reworked by fluvial action and redeposited in a more recent period (probably Pliocene).2/ For this reason,

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2/ Adams, George I.; Buts, Charles; Stephenson, L.W.; Cooke, C.Wythe; Geology of Alabama, Geological Survey of Alabama, Special Report No. 14, with accompanying geological map of Alabama, 1926.

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river gravels, sands, and sandy clays, generally deeply weathered, are found at higher elevations lying on and adjacent to the areas of Cretaceous sediments, which are so nearly of the same character as to be hardly distinguishable in many places. These fluvial deposits originally covered most of the region, but have been subsequently eroded and in considerable measure removed by stream action in recent geologic time.

Topography: The watershed of Yellow Creek is at the southern extremity of the Cumberland section of the Appalachian Plateau. The streams of this section are flowing in deeply incised meandering valleys that often assume gorge-like proportions. On the outside of stream bends the banks are vertical whereas on the inside of bends they are more gently sloping. The dissected valley of Yellow Creek in the vicinity of Harris Lake averages about one mile wide and 200 feet deep, but the flood plain has an average width of only 500 feet on stream bends, and is practically nonexistent in comparatively straight gorges where the gradient is steep. However, about one-third of the distance from the dam to the head-waters of Yellow Creek the flood plain attains a maximum width of approximately 1000 feet.

The divides are gently undulating and in some places almost flat, but break sharply to form the valley slopes. They represent remnants of the topography of the plateau region before stream dissection began in recent geologic time. The elevation of this old surface ranges from a maximum of 640 feet above sea level on the head-waters of Yellow Creek to approximately 370 feet in the vicinity of the dam of Harris Lake, a lateral distance of about 12 miles. Other divides in the vicinity of the lake, but farther from the influence of Black Warrior River, are approximately 470 feet in elevation.

Soils: The two geologic groups in this watershed produce distinct soil series and types. The plateau soils, or those derived from the Coal Measures of sandstone and shale, belong to the DeKalb and Hanceville series, and the Coastal Plain soils to the Orangeburg, Ruston, Norfolk, and Greenville series.

Of the plateau soils, as shown on the county soil map 3/

3/ Winston, R. A.; Latimer, W. J.; Cantrell, L.; Wilkinson, W. E.; McGehee, A. C.; Soil Survey of Tuscaloosa County, Alabama; U.S.D.A. Field Operations of the Bureau of Soils, and accompanying soil map, Thirteenth Report, 1911, pp. 933-1002.

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only the DeKalb stony loam is represented, although probably areas of Hanceville, too small to map in detail, are present. The DeKalb soils have gray to yellowish topsoil and pale yellow friable subsoil. The Hanceville soils have grayish brown or red topsoil and red friable subsoil. The chief distinction between the two types is in the color of the subsoil, which is yellow in the DeKalb, probably because of incomplete oxidation and weathering, and red in the Hanceville, owing to more advanced oxidation. The stony loam of both types produces poor agricultural land and is suitable only for forage crops, grazing, and timber. Only small patches of these types are cultivated in the watershed of Yellow Creek.

Of the Coastal Plain soils, the Orangeburg, Ruston, and Norfolk are most abundant. The same soil types are developed from the original Tuscaloosa formation and from sediments derived from this formation by fluvial action. Determination of the soil types is dependent more on the degree of oxidation, which is a function of permeability, than on the origin of the material. All of the soils have a grayish sandy surface horizon, the gravelly types having, in addition, small rounded quartz, chert, and sandstone pebbles. The subsoil of the Orangeburg is red sandy clay; of the Ruston, brownish yellow to yellowish red sandy clay (less oxidized than Orangeburg); and of the Norfolk, yellow sandy clay. The Norfolk is found usually on level surfaces of the upland. Scattered through the watershed, there are also small areas of Greenville loam, a dark brown to reddish brown loam underlain by red sandy clay.

The following are the percentages of soils mapped in the watershed by the Bureau of Chemistry and Soils, as planimetered from the Tuscaloosa County soils map.4/

4/ See footnote 3.

Orangeburg fine sandy loam.....43.84%

Norfolk fine sandy loam.....11.81%

Ruston fine sandy loam.....12.42%

DeKalb stony loam..... 8.71%

Orangeburg gravelly sandy loam.....23.02%

Greenville loam..... 0.20%

Erosion conditions: On the gently rolling upland inter-stream areas, on the forested steeper slopes, and on the small flood plain areas, erosion is moderate. On the steeper sloping cleared land, however, both sheet and gully erosion are pronounced. The soils eroding most severely are those of Coastal Plain origin, whereas the fine textured plateau soils erode less readily. The plateau soils, however, are carved through to bedrock by gullying in numerous places. Sheet erosion on these soils often strips the soil to bedrock, leaving patches of exposed rock in cultivated or idle fields and pastures.

Most of the streams in the area have cut their channels to bedrock, and having a steep gradient they are moving a considerable quantity of material. The sources of this material, in probable order of importance, are: (1) sheet and gully erosion on the steeper slopes and on the interstream areas, (2) lateral cutting on stream banks, especially on stream bends, and (3) corrasion on the stream beds.

Much sand from the Coastal Plain deposits on the divides is brought down the slopes by sheet erosion and by soil creep, so that many of the slopes consist of mixed phase sandy and gravelly soils. Part of this erosional debris is carried into the stream and eventually deposited in the lake.

Land Use - Forests: About 85 percent of the watershed above Lake Harris is forested. The Coastal Plain areas, once covered principally with long-leaf pine, are now forested with old-field and loblolly pine, scrub oak and a sprinkling of other hardwoods. The steep and rocky valley sides of plateau soils have sparse timber, the types being various oaks, gum, hickory, and a few pines.

Pasture and idle land: Few pastures are found in this area; idle and worn out farm land, now covered with broom sedge and coarse weeds, form the principal grazing areas. About 5 percent of the land is classed under this type.

Cultivated land: About 10 percent of the area, practically all the level upland, is farmed. Less than a dozen farms, consisting mainly of small patches, are located on the steep valley sides.

Crops: The principal crops are cotton, corn, oats, cow-peas, rye, sorghum or sugar cane, garden truck and small fruits.

Mean annual rainfall: 51.06 inches at Tuscaloosa.

Inflow into reservoir: No gaging records are available.

Evaporation: Negligible.

Average draft: 2,500,000 gallons daily.

The season of greatest use is from June to November, during which time the draft is approximately 3,000,000 gallons per day.

HISTORY OF SURVEY

Lake Harris was surveyed between October 30 and November 6,1935 by the Eastern Sedimentation Party of the Soil Conservation Service, under the direction of Louis M. Seavy, Chief of Party. Other members of the party were Gene A. Zwerner, Assistant Chief; Earl H. Moser, Jr., Wm. G. Shannon, and Arnold B. Taylor, Assistant Engineering Field Aides. A study of sedimentation features and a brief reconnaissance of the watershed was made by the writer.

During the survey 19 cross-section ranges were set up by plane table and stadia, and checked by triangulation. Along each range both the original profile and the present profile of the reservoir floor were established by sounding and by direct silt measurement. The silt depths were obtained at intervals along the range with the spud, or direct measuring apparatus, developed by this Project.

Range ends were marked with galvanized iron pipe on which station numbers were stamped for use in future resurveys.

The mapping scale used in this survey is one inch equals 200 feet. The original maps, from which the crest-line contour is taken, are of the same scale, with 5 foot contours over the whole basin. The accuracy of these maps was checked at every range end and by mapping several sections of shore line.

ACKNOWLEDGMENTS

The Soil Conservation Service acknowledges the generous cooperation of both the Water and Engineering Departments of the City of Tuscaloosa, especially of Mr. C. S. Reed, Superintendent of Waterworks, and of Mr. A. C. Parker, City Engineer, in supplying various data and maps as well as boats and motors used in the survey. Pipe to mark range ends was furnished by the Water Department. Personal services of Mr. T. R. Terry, Keeper of the lake, are also acknowledged.

SILT DEPOSITS

The greatest depths of silt in the lake occur approximately 2500 feet below the head of backwater, on Range 28-29, where a silt depth of 4.7 feet was measured. On Range 32-33, 1100 feet above this point, only 0.7 of a foot was found. At this place the inflowing current is still too strong to permit much silt accumulation. On an intervening range 3.6 feet were encountered.

From Range 28-29 down the lake the silt depths decrease gradually from a maximum of 3.7 feet on the next lower range, 700 feet downstream, to 1.7 feet 500 feet farther, and to 0.3 of a foot on Range 13-16. This average maximum depth of about 0.3 of a foot is maintained to the dam, with several local exceptions. At the mouth of Coal Branch (Range 17-18) a depth of 3.3 feet was recorded, obviously due to silt swept into the lake from this tributary, which has a very steep gradient. In the quiet water behind the main dam, over which water never flows, the maximum silt depth is 0.9 of a foot. Near the spillway dam the maximum is only 0.2 of a foot.

Sediment in the channel near the head of backwater and for some distance downstream is sand. The sediment on the edge of or outside of the channel comprises bars of silty mud, with leaves, twigs, and other organic matter. Fine pure white, silty sand is found in the channel as far down as Range 24-25.

Muddy sediment in the upper portions of the lake is very dark and contains coarse organic material and occasional shale fragments, whereas sand in the channel is white and almost free of other materials. In the lower portions of the lake the mud is soft, oozy, and light gray in color.

The sand found near the head of backwater is derived chiefly from the Tuscaloosa sands, whereas the muddy sediments of the lower basin of the reservoir originate in the clayey subsoil of the Tuscaloosa and in the soils derived from the shales of the Pottsville. The organic material consists mainly of humus and coarser fragments of leaves and twigs from the forested areas of the watershed.

Efforts have been made to prevent coarser organic material, logs and other debris from entering the lake by stretching strands of steel cable between cribs, weighted with stones, across the stream. Trash caught behind this is frequently removed and burned. These structures have been recently damaged by floods and are not now as effective as formerly.

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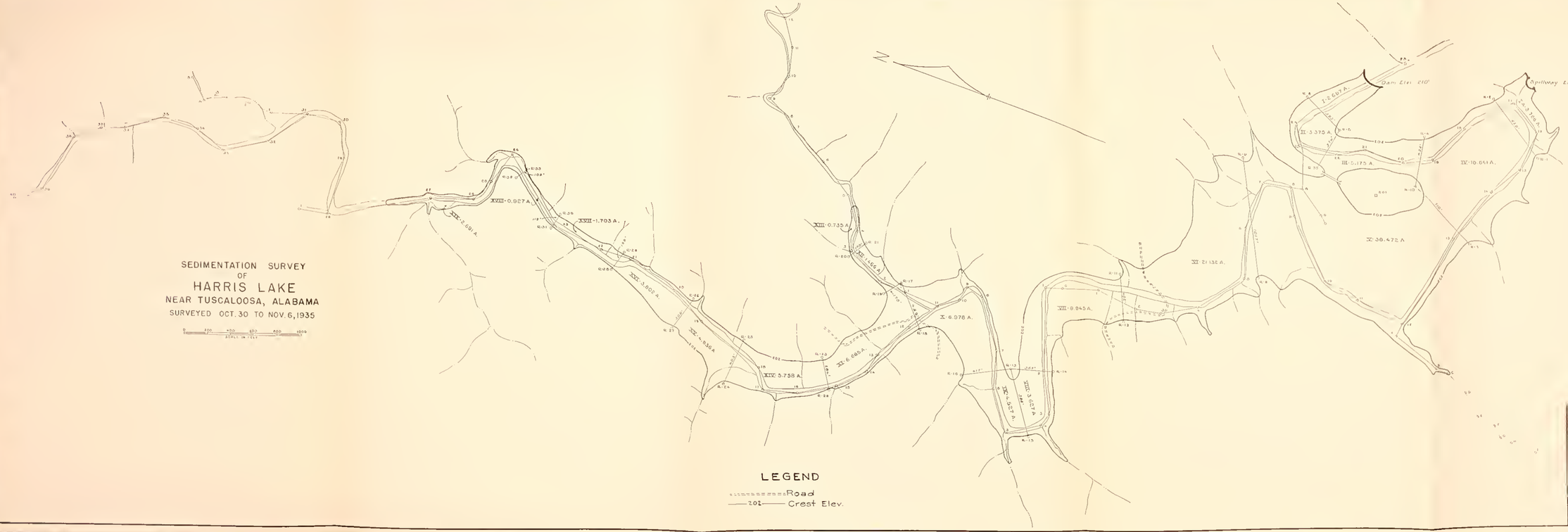
Table 1.--Statistical summary of data relating to LAKE HARRIS, TUSCALOOSA, ALABAMA.

	Quantity	Unit
Age: 1/	6.75	Years
Watershed:		
Total area	30	Square miles
Reservoir:		
Original area at crest stage	149.05	Acres
Present area at crest stage	149.05	Acres
Original storage capacity	2,420.5	Acre feet
Present storage capacity	2,372.8	Acre feet
Original storage per square mile of drainage area	80.68	Acre feet
Present storage per square mile of drainage area	79.10	Acre feet
Sedimentation:		
Delta deposits		
Bottomset beds		
Total sediment	47.7	
Accumulation per year average	7.06	
Accumulation per year per 100 square miles drainage area	23.53	Acre feet
Accumulation per year per acre of drainage area	16.02	Cubic feet
Or, assuming average weight of 1 cubic foot of silt is 100 pounds	0.80	Tons
Depletion of storage:		
Loss of original capacity per year	0.292	Percent
Loss of original capacity to date of survey	1.97	Percent

1/ Date storage began: February, 1929. Date of this survey: November, 1935.



SEDIMENTATION SURVEY OF
HARRIS LAKE
NEAR TUSCALOOSA, ALABAMA

DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
H. H. BENNETT, CHIEF

REFERENCE:
DRAWINGS FURNISHED BY LEWIS M. GRAVY

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COMPILED:	TRACED:	CHECKED:	DATE:	
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